Using Interpretive Structural Modeling to determine the variables drive the Relation between China and African countries

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Abstract:

This paper attempts to explain the underlying driving factors that govern the Chinese relationship with African countries .Since the Cold War, China has increasingly been playing the role of a major power; but in some theaters. This paper attends to the study of factors which makeup cooperation relations with African countries .However, strategy is solely the cause for cooperation between China and African countries. The interpretive structural modeling approach is used as methodology in paper to study these factors and their relations to determinetheir levels

Keywords: Interpretive Structural modeling (ISM),Strategically ,tactical, operational.

I .INTRODUCTION

The contributive variables of relations have been collected and assimilated for further utilization of ISM methodology. Synthesis of review identified research gaps, whereby it was noticed that almost no academic work was done in the area of image management, probably because it is a newer concept. However, work has been done in some related elements. The research shall probably be able to close the visible academic gap. China's Africa policy is to establish and develop a new type of strategic partnership with Africa on the basis of advancing the fundamental interests of both sides .China addresses mutual-benefit under framework of strategic partnership. It established strategic goals through

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programmatic pursuits, including political cooperation, economic interactions and cultural exchange and so on as shown in the white paper. African countries collectively become an important trade partner, especially a reliable oil export for China. African oil has the characteristic of low sulphur content which is good for environmental protection, and its location West Africa makes for easy processing by Chinese refineries (Naidu and Davies, 2006:73). So, China treats Africa purely as a resources base .Agriculture is the base for developing and rural economies and it is very vital to target sustainability for economic development and growth. Governments need to focus on formulating development policies which depict inclusiveness in all fields. In the context of the definition of development, it is important to study the concept of sustainable development which is commonly used now a day. This term was highlighted as "Meeting the needs of the present generation without compromising on the needs of the future generations" (World Commission on Environment and Development .(So the developments of china and Africa relations have to meet the sustainable development in Africa societies.

Objectives :

1to highlight how variables contribute to sustainable relationships between China and African countries .

.2To determine leading variables that drive relations between China and African countries.

Literature Review:

Approaches adopted for Literature Review, a structured systematic literature review has been adopted using a secondary data from books, articles that aid the study of development relation between China and African countries. China's interests in Africa include at last five dimensions of national interest: political, natural resources, economic, security, and ideological .It seeks Africa's support for the communist party's domestic political legitimacy and for its foreign policy agenda

internationally. China makes use of its aid and investment to support three priorities: strategic diplomacy, ideological values and commercial benefit. A Chinese relation with Africa nations reflects these priorities. So China relationship with Africa is largely driven by the following key considerations; china needs resources notably crude oil to power its modern growing economy and to support its expanding industrial base. The rapid growth of its manufacturing sector has also created increased domestic demand for natural resources including oil, gas, precious metals, aluminum ,copper and iron ore (Piet Konings, 2007). The followings tables show how China deals with the African countries in terms of resources and trade.

Table 1. China's import crude oil 1995-2006(%)

	1995	2000	2003	2006
Africa	11	24.0	24.4	32

Source :Lai, 2007,('China's oil diplomacy: is it a global security threat? P 522, cited from year book of China's economic foreign relations and trade, 2000, 2003; Zhao, 2007, China-US oil rivalry in Africa.)

The table (1) shows china's import crude oil percentage from Africa during the period from 1995-2007. The percentage increase steadily until reach 32% in 2006.

Table 2. China's trade volume with the Africa (billion USD)

Year	Trade with Africa	Weight
2000	10	%0.2
2005	397.4	%2.8
2006	554.64	%3.2
2007	733.11	%3.4

Source :Ministry of Commerce of the People's Republic of China

Table 3. China's exports to Africa (billion USD)

	2001	2004	2005	2006	2007
Exports volume to Africa	60.1	138.2	186.8	266.9	372.9

Source) :Ministry of Commerce of the People's Republic of China, 2006 Statistical Bulletin of China's outward foreign direct investment)

Table 3 shows Africa's population is seen as potential market for Chinese products. African gain from Chinese relations is that the Chinese government imposes no political conditions on African governments before signing contracts either for exploration or other economic activities (Piet Konings, 2007) .African imports from China are more diverse but three major areas are dominant: machinery and transport equipment, manufactured goods, and handicrafts (Mthuli Ncube, 2010). Because their prices are generally cheap and could be easily affordable to a large number of people. And these products fit into income level in each African country.

Table 4. Projections for China's Commodity import demand

Commodity	Unit	Latest Demand	Predicted Demand in 2020
Iron Ore	mtons	148	710
Oil	mtons	91	1861
Soy	mtons	26	50
Coal	mtons	11	810
Copper	mtons	3	20

Manganese	mtons	3	13
Meat	mtons	0.3	4
Wood	mcubic	34	150

Source: Deutsche Bank Research Report.

Table 4 shows the latest demand and projected of China for natural resource from Africa.

II. METHODOLOGY

This study is based on Systematic Literature Review. The secondary data in this research was collected from research books, journals and web sites. For the study the researcher had decided to follow a quantitative approach and therefore the research methodology included a theoretical study, a survey and an empirical study.

Interpretive Structural Modeling (ISM)

Interpretive Structural Modeling (ISM) enables the individual or a group of them to manage the interrelations between two or more elements at a time without compromising and deviating from the actual properties of the original elements/issues (Sage, A.P. 1977) .ISM provides a framework for delineation of a hierarchy amongst variables, influencers or elements of any project under consideration .This kind of modeling is seen as a useful tool that helps logical thinking and carefully approaching complex issues and then communicating the results of that thinking to others. ISM is much more flexible than many conventional quantitative modeling approaches that require variables to be measured on ratio scales. It offers a qualitative modeling language for structuring complexity and thinking on an issue by building an agreed structural model. ISM is structural as it extracts hierarchy form a different combination of variables .It has a mathematical foundation, philosophical basis and a conceptual and analytical.

Research Design:

Following is the process involved in ISM

a- Identify and list elements/variables relevant to the factors contribution for developing relations between China and Africa, through a literature review
b- A SSIM is developed to indicate a relationship between variables undertaken.
c- Convert the SSIM developed into a reach ability matrix.
d- The next step is to then test the transitivity (if A depends on B and B depends on C, then by principle of transitivity, A depends on C), make modifications to satisfy the transitivity requirements and derive the final reachability matrix.
e- Model levels are derived by iterative partitioning of the reach ability matrix.
f- Translate the relationships of reachability matrix into a diagraph and convert it into an ISM (Interpretive Structural Model).
g- The model is then reviewed for inconsistencies the model for conceptual inconsistencies and revised accordingly.

III. RESULTS AND DISCUSSION

Identification of Variables:

A variable is a characteristic that is measurable and has amplitude, intensity or both. The.

variables identified in the research have been drawn out of the systematic literature review. These emerged single or multiple times in the search. The bias in identification or selection was obviated, since even a single meaningful mention of a variable was given credence; which was validated by practicing image consultants through personal interaction or electronic mail or telephone. The variables thus identified which are believed to be the core variables towards development relationships are as follows:

Table 5: Shows factors identified from literature

S/N	Factors(Variables)
.1	Natural Resources
.2	Market
.3	Politics
.4	Ideological
.5	Security

Source: Secondary Data

Table 6: Shows Variables as Symbol V

S/N	Factors in words	Symbol of Variable
1	Politics	V1
2	Natural Resources	V2
3	Market	V3
4	Ideological	V4
5	Security	V5

Source: Secondary Data

Structural Self Interaction Matrix) **SSIM**:

For development of the SSIM (see Table 8), ISM methodology suggests that experts' views are used for defining contextual relationship among variables, in line with objectives of the study. The following rules are used for forming SSIM.

Table 7: Rules for forming SSIM

symbol	Relationship between row(i) and column(j) factor
V	Factor(i) lead to factor(j), not in reverse direction
A	Factor(j) lead to factor(i), not in reverse direction
X	Factor(i) and factor(j), lead to each other in both direction
O	Factor (i) and (j) are unrelated to each other

Table 8: SSIM Matrix

i&j	V5	V4	V3	V2	V1
V1	V	A	A	X	
V2	V	X	A		
V3	X	V			
V4	V				
V5					

Reachability Matrix:

The next step is to convert the SSIM matrix into binary matrices called initial.

reachability matrices. This is done by replacing V, A, X and O by One (1) or Zero (0) in accordance with the VAXO rules. The following has been followed to derive the binary.

matrix: If the entry of (i,j) in the SSIM is 'V', then enter the value of the element (i,j) as '1' and subsequently (j, i) as '0' in initial reachability matrix If the entry of (i,j) in the SSIM is 'A', then enter the value of the element (i,j) as '0' and subsequently (j,i) as '1' in initial reachability matrix If the entry of (i,j) in the SSIM is 'X', then enter the value of the element (i,j) as '1' and subsequently (j,i) as '1' in initial reachability matrix . Finally, if the entry of (i, j) in SSIM is 'O', then enter the value of the element (i, j) as '0' and subsequently (j, i) as '0' in the initial reachability matrix.

Table 9: Reachability Matrix

i&j	V1	V2	V3	V4	V5	Driving factors
V1	1	1	0	0	1	3
V2	1	1	0	1	1	4
V3	1	1	1	1	1	5
V4	1	1	0	1	1	4
V5	0	0	1	0	1	2
Dependent factor	4	4	2	3	5	

Level Partitioning:

The final reachability matrix obtained after completing the transitivity requirements based on the relation mentioned above is used for level partitioning. It involves comparing the 'reachability' and 'antecedent' sets of variables and delineating levels on the basis of intersection sets. It leads to arriving at a reachability set for a variable by considering the variable with itself along with other set of variables that causes an impact. The antecedent set comprises of comparing the variable and a set of all those variables that have an impact on the primary variable. The hierarchy in ISM is decided by the level of similarity in reachability and intersection sets (Table 10). These variables would not impact any other variables.

Table 10 :Level 1 identification

i& j →	Reachability Set	Antecedent Set	Intersection Set	Level
V1	1,2,5	1,2,3,4	1,2	
V2	1,2,4,5	1,2,3,4	1,2,4	I
V3	1,2,3,4,5	3,5	3,5	
V4	1,2,4,5	2,3,4	2,4	
V5	3,5	1,2,3,4,5	3,5	

Level 1 is identify as natural resources (V2)

Table 11 :Level 2 identification

i& j →	**Reachability Set**	**Antecedent Set**	**Intersection set**	**Level**
V1	1,6	1,3,4	1	
V3	1,3,4,6	3,6	3,6	II
V4	1,4,6	3,4	4	II
V5	3,6	1,3,4,6	3,6	

Level 2 is identified as market) V3) and security (V5)

Table 12: Level 3 identification

i&j	Reachability Set	Antecedent Set	Intersection Set	Level
V1	1	1,4	1	III
V4	1,4	4	4	III

Level 3 is ideological (V4) and politics (V1(

Formation of Digraph from Reachability Matrix:

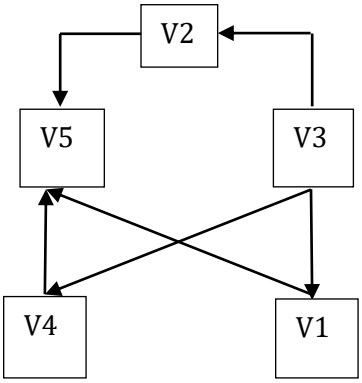

Figure 1 :Digraph of the China and Africa relations factors showing relationship between the factors.

Formation of ISM - Based Model:

From the final reachability matrix, the structural model is generated. If the relationship exists between the variables j and i, an arrow pointing from i to j shows this. This resulting graph is called digraph .The digraph is finally converted into the ISM model. It is observed that natural resources are a very significant variable for relationship between China and Africa at the top of the hierarchy .

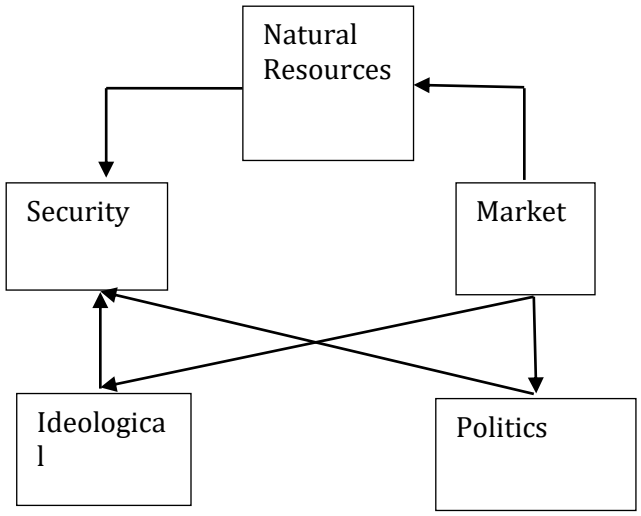

Figure 2 :Model depicting relations between China and Africa relations factors based on ISM.

MICMAC Analysis:

MICMAC is used to examine the Driving Power and Dependence Power of the variables.

The variables have been classified into four categories called as Autonomous ,Linkage ,Dependent and Driving variables. The following is the meaning of the 4 categories-:

1-Autonomous Variable :This indicates a weak driving power and subsequently a weak dependence power. The variables are disconnected from the system

2-Linkage Variable :This indicates a strong driving and strong dependence power. The factors are unstable; any action on these variables will have an effect on others and a feedback effect on themselves.

3- Dependent Variable :This indicates a weak driving power but strong dependence power. Any action on them will have an effect on others and also feedback effect on themselves.

.4Driving Variable :This indicates a strong driving power but weak dependence power.

Table 12 :Driving and Dependent Variables for MICMAC Analysis

Factors	Variables	Driving Variables	Dependent Variables
Politics	V1	3	4
Natural resources	V2	4	4
Market	V3	5	2
Ideological	V4	4	3
Security	V5	2	5

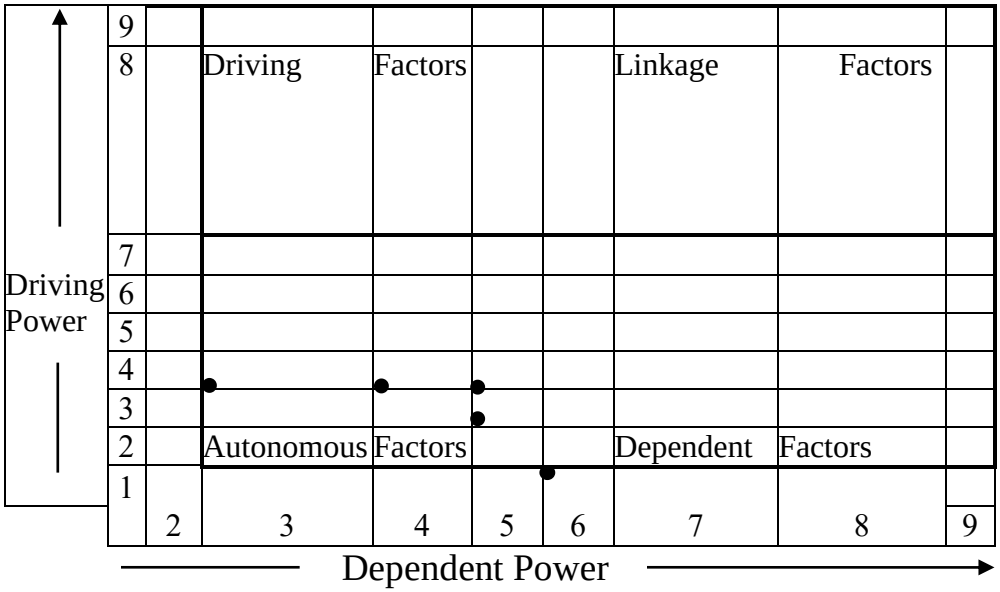

Figure 3: Graph of MICMAC Analysis

MICMAC Analysis:

The objective of the MICMAC analysis is to analyze the driver power and dependence power of variables. The variables are classified into four clusters (Figure 3). The first cluster consists of autonomous variables that have weak driver power and weak dependence power. These variables are relatively disconnected from system with which they have only few links which may be strong. Autonomous Variable ,This indicates a weak driving power and subsequently a weak dependence power.

The variables are disconnected from the system. The dependent has no factors, also the driving and linkage have no factors

IV. CONCLUDING REMARKS

In this paper, an attempt has been made to review the literature for deployments of ISM in determine the relationship between China and Africa relations factors. From ISM it is clear that, the natural resources is on the top, the strategically level of the relationship, the market and security are at middle level, the tactically level and politics and ideology are at the base or the lower level, the operational level. From that, the relationship between china and Africa is led by seeking natural resources and market in Africa .

The conclusion drawn from the ISM Hierarchy shows high interrelationship and interconnectivity between China and Africa relationships factors. And three levels are resulted. The level one, is the strategically level contains natural resources, level two, is the tactical level contains market and security, and the level three, is the operational level, contains politics and ideology. In concluding remarks ,**China is seeking natural resources and market in Africa and Africa want development from China** .To develop Africa is necessary to process natural resources and exported as final product instead of crude product. And protect African producers in the market by imposing protections measures and quality control ..

V. RECOMMENDATIONS

Since the driving variables are natural resources and market as strategy and tactic relation between China and African countries. The study recommended that the natural should be processed before exported, and export as a finished product. This will accelerate the development in Africa .And apply quality control measure and tariff for import goods from China to Africa .

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